ROYAL ASTRONOMICAL SOCIETY.

VOL. XVII. *February* 13, 1857. No. 4.

THE Annual General Meeting of the Society, MANUEL J. JOHNSON, Esq., President, in the Chair.

William Curtis Otter, Esq., 18 Grosvenor Park (North), Camberwell; and
William Walter Spencer Stanhope, Esq., 51 Harley Street,
were balloted for and duly elected Fellows of the Society.

Report of the Council to the Thirty-seventh Annual General Meeting of the Society.

The Council proceed to lay before the Fellows their Report for the past year. There have been years in which there has been more of striking interest to detail; but, nevertheless, the science of astronomy, though perhaps the oldest of the sisterhood, shows every sign of continued vitality.

The Report of the Auditors, subjoined, will show the state of the finances:—

RECEIPTS.

	£	s.	d.
Balance of last year's account	578	3	7
By dividend on £1650 Consols	23	2	0
By ditto on £2878 17*s.* 5*d.* new 3 per Cents	40	6	1
By ditto on £1650 Consols	23	2	0
By ditto on £2878 17*s.* 5*d.* new 3 per Cents	40	6	1
Cash per Lawson's executors	200	0	0
Dividend on £1650 Consols	23	2	0
On account of arrears of contributions	70	18	0
102 contributions (1856–57)	214	4	0
5 ditto (1857–58)	10	10	0
Carried forward	£1223	13	9

	£	s.	d.
Brought forward	1223	13	9
Compositions	94	10	0
15 admission-fees	31	10	0
14 first year's contributions	24	3	0
Sale of Publications	79	3	6
	£1453	0	3

EXPENDITURE.

	£	s.	d.
Cash paid George Barclay, printer	165	5	8
Ditto J. W. Rumfitt, bookbinder	10	0	0
Ditto Mr. R. Grant	20	0	0
Ditto J. Deville, gas-fittings	29	18	6
Ditto Mr. R. Grant	10	0	0
Ditto J. Binnington, carpenter	27	0	6
Ditto G. Barclay, printer	142	5	9
Ditto J. W. Rumfitt, bookbinder	18	19	6
Taxes { 1 year's land tax 5 10 0; half-year's property tax 3 6 8 }	8	16	8
J. Williams' salary, 1 year	100	0	0
Ditto commission on collecting £430 8*s.* 6*d.*	21	10	6
Charges on books, and carriage of parcels	2	5	3
Postage of letters and Monthly Notices	28	2	5
Porter's and charwoman's work	25	3	10
Tea, sugar, biscuits, &c. for evening meetings	15	13	0
Coals, candles, &c.	12	10	6
Waiters attending meetings	4	8	0
Sundry disbursements by the Treasurer	36	18	10
Expenditure of Turnor Fund	9	3	6
Banker's commission on collecting country cheque	0	1	0
Balance in the hands of the Treasurer	764	16	10
	£1453	0	3

Assets and present property of the Society on Feb. 8, 1857:—

	£	s.	d.
Balance in the Treasurer's hands, including £36 0*s.* 11*d.* balance of Turnor Fund	764	16	10
Due for arrears on which various sums have been paid by 4 Fellows	41	19	0
3 contributions of 5 years' standing 31 10 0			
4 ——— of 4 ditto 33 12 0			
4 ——— of 3 ditto 25 4 0			
19 ——— of 2 ditto 79 16 0			
26 ——— of 1 ditto 54 12 0	224	14	0
Due for publications of the Society	1	8	6

£1650 3 per Cent Consols.
£2878 17*s.* 5*d.* new 3 per Cent.
Unsold publications of the Society.
Various astronomical instruments, books, prints, &c.

Stock of volumes of the *Memoirs*:—

Vol.	Total.	Vol.	Total.	Vol.	Total.
I. Part 1	37	VIII.	204	XIX.	251
I. Part 2	79	IX.	208	XX.	250
II. Part 1	97	X.	220	XXI. Part 1 (separate).	302
II. Part 2	64	XI.	235	XXI. Part 2 (separate).	101
III. Part 1	125	XII.	243	XXI. (together).	151
III. Part 2	145	XIII.	255		
IV. Part 1	145	XIV.	442	XXII.	249
IV. Part 2	160	XV.	247	XXIII.	247
V.	173	XVI.	251	XXIV.	288
VI.	193	XVII.	239		
VII.	217	XVIII.	235		

In forming the table representing the state and progress of the Society, it has been found that, owing to the method hitherto followed of taking the preceding table for granted, various necessary corrections, such as deaths learned too late for insertion, changes of annual subscribers into compounders, &c., have been omitted. The consequence is, that in every item the table for 1856 represents the Society as rather larger than it really is: the total being 27 too great. The following table shows the list as corrected for February 1856, and as carried on to February 1857. In future the correctness of the starting list will not be assumed:—

	Compounders.	Annual Contributors.	Non-residents.	Patroness, and Honorary.	Total Fellows.	Associates.	Grand Total.
February 1856	153	197	61	5	416	58	474
Errors	+4	+12	+5	+1	+22	+5	+27
Correct total, 1856...	149	185	56	4	394	53	447
Since elected	3	13	...	1	17	...	17
Deceased	−3	−4	−4	...	−11	...	−11
Removals	3	−2	−1	...	...	...	...
Expelled	...	−4	...	...	−4	...	−4
February 1857	152	188	51	5	396	53	449

The instruments belonging to the Society are now distributed as follows:—

The *Harrison* clock,

The *Owen* portable circle,
The *Owen* portable quadruple sextant,
The *Beaufoy* circle,
The *Herschelian* 7-foot telescope,
The *Greig* universal instrument,
The *Smeaton* equatoreal,
The *Cavendish* apparatus,
The *Lee* circle,
The 7-foot Gregorian telescope (late Mr. Shearman's),
The Universal quadrant by Abraham Sharp,
The *Fuller* theodolite,
The Standard scale,
The Variation transit (late Mr. Shearman's),

are now in the apartments of the Society.

The Brass quadrant, said to have been *Lacaille's*,

is in the apartments of the Royal Society.

The remaining instruments are lent, during the pleasure of the Council, to the several parties under mentioned, viz.: —

The *Beaufoy* clock,
The two invariable pendulums, } to the Royal Society.

The other *Beaufoy* clock, to the Rev. J. B. Reade.

The *Wollaston* telescope, to the Rev. T. W. Webb.

At a General Meeting held after the ordinary meeting in December, it was determined to make the following alterations in the bye-laws relating to the award of the medal. Of the persons (if the plural number can be used) nominated, as under the existing law, in November, one is to be selected by the Council in December, as the person to whom, of all who have been nominated, it is most expedient to award the medal. At the following meeting, in January, the absolute claim of this selected nominee is to be considered on the simple question whether the astronomical labours specified in the minute of nomination are or are not worthy of the medal. Under the existing law, the members of the Council are all but required to vote on two questions at once, the question of relative merit and the question of absolute merit; and to combine these two questions in voting by ballot on the nominees, one after another. The inconveniences of this combination of questions showed themselves on past occasions in so striking a manner that the Council felt they had no alternative but to submit to the Society at large a proposal for an alteration in the bye-laws.

The medal for this year has been awarded to M. Schwabe, of Dessau, for the skill and perseverance exhibited in a thirty years' series of observations on the spots of the sun,—a series, which

has already contributed to the production of very remarkable results. The President will, at the close of this day's proceedings, enter upon the grounds of this award in the usual manner.

The Council have the satisfaction of announcing to the Society that the twenty-fifth volume of the *Memoirs* is now ready for publication. The subject-matter is of a varied character, and will be found in several respects to be eminently deserving of attention. A paper, by Mr. Main, on the dimensions of the rings of *Saturn*, contains the details of an investigation by that astronomer, which was briefly alluded to in the last Report of the Council. It is plainly demonstrated in this paper that, from the time of Huyghens down to the present day, no sensible change has occurred in the relation of the rings of *Saturn* to the body of the planet.

When we consider the high reputation of Mr. Main as an observer, the admirable instrumental means which he employed in the prosecution of his labours, and the extensive series of measures upon which his results are founded, we feel assured that the Society will agree with us in regarding the results deduced by him as forming an important contribution to astronomical science.

We owe, also, to Mr. Main a paper on the diameters of the other planets, which contains some interesting results. The definitive result for the diameter of *Venus*, when taken in conjunction with the value of its mass, as derived from other considerations, assigns to the planet a somewhat less density than it has hitherto been supposed to possess. It is a remarkable fact, that the evening measures of the disk would seem to indicate no sensible traces of irradiation. The researches on the diameter of *Jupiter* have led Mr. Main to a considerably less value of the ellipticity of that planet than has hitherto been assigned by observers. This conclusion, which has been confirmed by the measures of Mr. De La Rue and Professor Secchi, will, no doubt, suggest useful discussion on the relative advantages of the various micrometers employed in observations of this kind. It will also tend to throw some light on the physical theory of the satellites of *Jupiter*, in which the ellipticity of the primary plays an important part.

Perhaps there is no branch of astronomical science, which has opened a wider field of observation and research than the subject of double stars. The volumes of our *Memoirs* are peculiarly rich in contributions relating to this class of objects. We find in them the original exposition of the best practical method which has yet been devised for determining the orbit of a double star, and which we owe to one of the most distinguished ornaments of the Society. The observations, however, as might naturally be expected, are chiefly confined to the northern hemisphere. The volume of *Memoirs* for the past year contains a paper on double stars, by Mr. E. B. Powell, who has taken advantage of his residence at Madras to observe many of such objects, which

are not visible at any European Observatory. Mr. Powell has appended to his micrometrical measures a number of valuable notes, in which he has discussed the various circumstances relative to the orbitual movements of some of the more interesting binary systems recorded in his catalogue.

Mr. Ellis, one of the assistants at the Royal Observatory, Greenwich, has contributed a very interesting paper relative to the true interpretation of an inscription, which appears on some ancient tablets recently discovered in Egypt by the Rev. Mr. Stobart. Soon after their existence became known, these tablets were submitted to a careful examination by M. Brusch of Berlin, who arrived at the conclusion that the inscriptions represented a series of observed places of the five principal planets, and that the period of observation fell in the reign of the Roman Emperors, Trajan and Adrian. The attention of the Astronomer Royal having been drawn to the subject, he gave instructions to Mr. Ellis to scrutinise M. Brusch's interpretation of the inscriptions, with the view of ascertaining whether the conclusions at which he arrived were consistent with the theories of astronomical science. Mr. Ellis has executed the task assigned to him in a paper distinguished by careful research and skilful criticism. He has proved, beyond all doubt, in accordance with the views of M. Brusch, that the inscriptions indicate a series of places of the five principal planets. He also corroborates the conclusion arrived at by that *savant* with respect to the epochs of the places, but he differs from him in so far as he has demonstrated that, instead of being observed places, they are the results of calculation. The paper is eminently worthy of the attention of every person who takes an interest in the literature of our science.

Mr. Pritchard, in a short paper, has rectified a mistake in chronological astronomy, which appears to have obtained some currency in recent times. Dr. Ideler has asserted, in a well-known work, that certain conjunctions of *Jupiter* and *Saturn*, which occurred in the year 7 B.C., would satisfy the circumstances recorded of the star of the Magi; and this explanation of the phenomena of the star has been adopted by some subsequent writers. Mr. Pritchard, however, having submitted the places of both planets to strict calculation, found that, although these conjunctions actually did occur in the year 7 B.C., on none of those occasions were the planets sufficiently close to present the appearance of a single star; nor, even admitting this to be true, were they in the proper position at sunset to justify the supposition of their identity with the star of the sacred writings.

The volume of *Memoirs* closes with a note by Professor Smyth, containing the results of a discussion of a series of earth-thermometer observations prosecuted at the Observatory of Edinburgh between the years 1838 and 1854. These thermometers were originally established by the British Association, under the superintendence of Professor J. D. Forbes. The bulbs were buried in

the porphyry rock of the Calton Hill at different depths, the tubes rising to the surface, where the indications were read off by the aid of suitable scales. Professor Smyth has shown very satisfactorily, by a comparison of the mean results for each thermometer, that the temperature steadily increases towards the centre of the earth. He has also found traces of a secular inequality which, he is inclined to suppose, is so far indicative of the sun belonging to the class of variable stars.

With respect to the *Monthly Notices*, the Council have few remarks to make, in addition to what has been already stated at former anniversaries of the Society. The utility of this Journal in presenting a condensed view of the progress of astronomy in England, with an occasional reference to the state of the science in other countries, is now universally acknowledged; and it only remains for the Council to urge upon each individual member of the Society the desirableness of contributing towards its pages. Astronomy is a science of such vast extent as to offer a peculiarly wide field of selection to the amateur who may be desirous of devoting his attention to the cultivation of any of its branches. When we take into consideration the many excellent private observatories, which have been established in this country, it can hardly be doubted that much advantage would accrue to astronomy if their resources were more extensively employed in the careful execution of extra-meridional observations. Nor can the Council omit to remind the Fellows of the Society that many of them, who possess no appliances for the purposes of observation, are, notwithstanding, perfectly competent to execute the processes of calculation, which conduce to the advancement of astronomy. The *Monthly Notices* supply an easily accessible channel for disseminating the labours of both these classes of amateurs.

We have to regret the loss by death of the following Fellows:—Dr. George Butler; Admiral F. W. Beechey; Thomas Donkin, Esq.; Thaddeus Foley, Esq.; Rev. William Giles; Captain Thomas Graves, R.N.; Robert Arthur Graham, Esq.; Rev. John Phillips Higman; Rev. Samuel King; John Fletcher Miller, Esq.; William Lewin Newman, Esq.; Rear-Admiral Sir John Ross; Richard Wellesley Rothman, M.D.

Rear-Admiral Frederick William Beechey, F.R.S., who was one of the early members of this Society, earned his reputation by his conduct as an active officer, and by his skill as a scientific navigator. A son of the late Sir William Beechey, R.A., he was born in February 1796, and entered the Royal Navy in the summer of 1806. While serving as a midshipman on board the Astrea, of 36 guns, he bore a part in Commodore Schomberg's decisive frigate-action off the Isle of France, in May 1811. He afterwards served on the expedition to New Orleans, and was promoted to the rank of Lieutenant on the 10th of March, 1815.

Public attention having been drawn to Polar exploration, in January 1818, Lieut. Beechey obtained an appointment to the Trent, a hired brig commanded by the late Sir John Franklin, then a Lieutenant, and accompanied the expedition for northern discovery under Capt. David Buchan: of which voyage, Beechey published an account a quarter of a century afterwards. This attempt not having proved satisfactory, another expedition was fitted out under the command of the well-known Lieut. Edward Parry, and Lieut. Beechey was commissioned to the Hecla, in January 1819: this party having penetrated sufficiently into the Arctic circle to entitle them to the Parliamentary reward, he received the sum of 200*l.* as his portion. In 1821 he was appointed second Lieutenant of the Adventure, sloop-of-war, commanded by Capt. W. H. Smyth; and, in carrying out that officer's arrangements, he was landed at Tripoli with his brother and a selected party, to proceed from thence along the shores of the Regency, round the Gulf of Syrtis, through the Cyrenaica, and as far eastward as Dernah, in co-operation with the proceedings of the Adventure. This novel and interesting journey, which lasted till the end of July 1822, was performed entirely to the satisfaction of his captain; and the resulting details have since been given to the public in a volume entitled *Proceedings of the Expedition to explore the Northern Coast of Africa*, which was drawn up by Mr. Henry Beechey, and appeared in 1828.

Meantime Lieut. Beechey had been advanced to the rank of Commander in the Navy, and in 1825 was commissioned to the Blossom, of 24 guns; with directions to sail round by Cape Horn, and proceed to Behring's Strait; there to act in concert with the differently-directed movements of Parry and Franklin in their exertions to discover a north-west passage. This important voyage occupied three years and a half; during which they visited many climes, and made numerous nautical discoveries of great interest: and after traversing 73,000 miles, the Blossom arrived at Spithead with a freight of 1,500,000 dollars on board. She anchored in September 1828, and her captain had the pleasure to find that he had been posted exactly a year before. A very clear and interesting account of this undertaking was soon afterwards published, under the title, *Narrative of a Voyage to the Pacific and Behring Straits, to co-operate with the Polar Expeditions.* This book is a valuable addition to the standard works of our circumnavigators.

In 1835 Captain Beechey was appointed to the Sulphur, of 8 guns, for the purpose of surveying the west coast of South America; and a schooner, the Starling, was fitted as a tender. But at Valparaiso his ill-health compelled him to resign the command, and he returned home in the summer of the following year. But with the renewal of strength, he was at work again; and in 1837 joined the African, steamer, for the purpose of surveying on the coasts of Ireland and the opposite shores of England. This severe service was not only productive of some useful charts, but

also afforded many elucidations of the Channel tides: and he continued those labours in the Lucifer and the Firefly, also steamers, till he was called by the Government to constitute and superintend the Marine Department of the Board of Trade; a station, wherein he was zealously employed until his death, on the 29th of last November, when he closed a very useful and meritorious career. He had been promoted to the rank of Rear-Admiral on the 1st of September, 1854; and, at the time of his demise, filled the office of President of the Royal Geographical Society.

Thomas Donkin, born near Hexham, May 28, 1776, was a member of a family in which scientific talent is frequently displayed. His brother, Bryan Donkin, was well known to the world, and needs no commemoration in this room; his son is the Savilian Professor of Astronomy at Oxford, well known by his treatment of the most difficult mathematical subjects. The father of Thomas Donkin was a farmer and land-agent, and the son had little education, except what he gave himself. He took especial interest in every application of science, and acquired so much knowledge, and so wide a field of exercise, that there were few crafts, from that of a physician to that of a blacksmith, in which he could not have been useful on an emergency. His favourite pursuits were music, chemistry, and astronomy; and he was in the habit of furnishing his neighbourhood with the true time, having a small observatory with a transit and clock. He died January 19, 1856, in his eightieth year, leaving behind him a high character for uprightness as well as knowledge and intelligence. He had been a Fellow of this Society since 1823.

William Giles was born at Dartmouth, in Devonshire, on Dec. 30, 1798. It is told of him, that at eleven years he could remain in the water from two to three hours without touching anything but the water itself, and it was no uncommon thing for him to dive from the side of a loaded brig, pass under her keel, and come up on the other side. After eight years' residence at Oxford, he settled in Chatham, where he conducted a school. The celebrated Charles Dickens was one of his pupils. The science of astronomy became his favourite study, on which he delivered several courses of lectures at Chatham and elsewhere. After several changes of residence, he died at Chester, where he had settled for his health, Sept. 30, 1856. He was highly respected by his friends, as a man of strong intellect and high character.

Robert Arthur Graham (born May 14, 1805, died March 22, 1856) was one of the Fellows who came into the Society when the Mathematical Society was made a part of our body. He had been long a member of the Mathematical Society, and was a lover of science, and highly respected by those who knew him.

Captain Thomas Graves, R.N., son of the late Captain Thomas Graves, also of the Royal Navy, was born in November 1802; and being intended for maritime life, was sent, after a preliminary education, as a student to the Royal Naval College at Portsmouth, in March 1816. Here he conducted himself with such attention and ability, that in December 1817, he was sent, as a College Volunteer, into the Bulwark, of 74 guns, a guard-ship, then commanded by his father. He shortly afterwards sailed in the Ister to the Newfoundland station, and served in the Creole and Hyperion frigates, in South America. In each of these ships an anxious desire for improvement in all branches of professional knowledge was so evident, as, on his return to England, to obtain for him a recommendation from Admiral Sir George Cockburn to Captain W. H. Smyth, to receive him on board the Adventure, sloop-of-war, as an Admiralty midshipman. In this vessel he acquitted himself with such zeal and intelligence, that after she was paid off in November 1824, he was retained by his captain till October 1825, to assist in getting up the charts of the Mediterranean survey in the Admiralty Office. In the meantime he had undergone his examination for a commission with such credit, that the passing captains felt themselves called upon to give him, besides the usual formal document, an extra certificate, of which the following is a copy:—

"These are to certify that Mr. Thomas Graves appeared before us for the purpose of being examined, touching his qualifications to serve as Lieutenant in his Majesty's naval service; and, on the perusal of his logs, and his being examined accordingly, he appeared to us to merit this additional mark of our highest approbation of his ability; and we further beg to recommend a perusal of his logs, which show a degree of care and attention worthy of imitation.

"Given under our hands, on board H. M. S. Rochford, Malta, 20th of January, 1823.

(Signed) "C. M. Schomberg,
W. C. Jervoise,
W. H. Smyth, } Captains."

The Adventure being commissioned for an exploring voyage to the Strait of Magellan and the adjacent shores, under Captain P. P. King, that officer, on the strong recommendation of Captain Smyth, received Mr. Graves as his Assistant-Surveyor. In this capacity he served from October 1825 to November 1830, two years of which he was in command of the Adelaide schooner, tender to the Adventure; during which time the Cockburn and Barbara channels, as well as much of the coast of those regions, were surveyed by him conjointly with Lieut. Skyring, who had also been brought forward by Captain Smyth for that employment. While thus actively occupied, Graves received somewhat tardily his first commission as lieutenant; it was dated 30th of April, 1827.

In July 1831, Lieut. Graves — being then on a visit to his parents at Castle Dawson in the north of Ireland — received an appointment to execute, in conjunction with the Ordnance Sur-

veyors, a plan of Lough Neagh; which he completed very satisfactorily in about ten months. He was then commissioned to the Mastiff, gun-brig, and sent out to the Archipelago, there to assist Captain Copeland in examining the islands and coasts; but his commander having resigned on account of ill-health, Graves was selected to conduct that interesting and valuable work in 1836. And most ably did he perform this great duty: for ten years he carried it on in the Beacon sloop, and when she was no longer sea-worthy, the Volage, corvette, was sent out to receive his pendant. In this ship he was completing his labours with such celerity, that the end of the expedition appeared to be in view, when the ship was most unexpectedly and peremptorily ordered to England, where she was paid off in December 1850. This inscrutable measure was one of surprise, not only to the service, but to Sir Francis Beaufort, the Hydrographer, himself; for he addressed a consolatory letter to Captain Graves, praising the prompt and vigorous energy which had characterised his whole career, and stating, — "We have worked so long together, and with so much harmony and fellow-confidence throughout, that the cessation of all further surveying intercourse really afflicts me,— and what makes a far greater impression than any personal feelings is the heavy blow which will be sustained by that branch of the service to which your persevering labours did so much credit."

Some of the results of these "persevering labours" are shown in upwards of fifty Archipelagan charts and plans, of such elaborate detail and accuracy that they are of the highest use, as well to the historian and scholar as to the navigator and traveller. Nor were these the only efforts of his attention: anxious to serve all branches of science, he *enlisted*, at his own responsibility and expense, in 1841, the late lamented naturalist, Professor Edward Forbes; who remained on board as his friend and companion, busily occupied for nearly two years. Nor was Forbes the only contributor to knowledge thus chosen; and the aid which he afforded to the investigation of Lycia and its antiquities has been warmly acknowledged. He received, through Sir Edmund Lyons, the distinct thanks of the Greek Government for his successful exertions in extinguishing an alarming fire at the Piræus in the year 1839; and the Sultan, Abdul Medjib, personally presented him with a handsome snuff-box, richly mounted in diamonds, in recognition of the benefit of his services both to navigation and commerce.

After his useful employment had been so unexpectedly and so injuriously interrupted at head-quarters, the mortified officer returned to Valetta, where, by the advice and documentary aid of Captain Smyth, he proposed to draw up a "Sailing Directory" of the whole Mediterranean Sea, for which his long acquaintance therewith peculiarly adapted him. The warm sympathy, however, of all ranks attended Captain Graves; and Sir William Reade, the present Governor, handsomely offered him the good post of

Marine Magistrate and Superintendent of the ports of Malta. This was gladly accepted, and he carried on the onerous duties of the office with honour and credit for upwards of three years. It happened that in consequence of a glaring breach of the enacted regulations, one Giuseppe Meli was brought before the Captain, and, after due inquiry, was sentenced to have his boat hauled up for a fortnight — a sentence in just accordance with the due discharge of the magistrate's official duty. But the hardened culprit loudly vowed vengeance, waylaid Graves, and stabbed him in the principal street in Valetta at noon-day. This was on Monday, the 25th of last August, after which the victim lingered till Thursday, when he expired. His remains were conveyed to their final resting-place on the evening of the following day, attended by the Governor, the Admiral, and all the principal authorities; and the mournful procession to the English cemetery was joined by a long line of officers, merchants, and inhabitants. From his great moral worth and benignant disposition he was very popular; his sad and untimely fate, therefore, spread a general gloom over the Maltese community. The murderer escaped full punishment by the perverse verdict of the Maltese jury, which decided that Captain Graves died a natural death.

Although, as we have shown, Captain Graves was almost constantly abroad, he evinced his love of science by becoming a Fellow of this Society so far back as January 1826; and he was one of the original Members of the Royal Geographical Society.

John Phillips Higman was born in Devonshire, October 26, 1792, and was originally intended for the medical profession. His turn for mathematical pursuits induced his friends, about 1812, to send him to Trinity College, Cambridge; Mr. Babbage was, we are informed, one of those who, on a casual acquaintance, discovered his powers, and advised the change of plan. He graduated in 1816, and was third Wrangler, following Mr. Whewell in the list of honours. He afterwards obtained a Fellowship, under circumstances of a rather unusual kind. At his first trial, his classical knowledge was so indifferent, that he received a friendly hint, sometimes given in such cases, that it would be useless for him to try again. This hint he used as follows: giving out that he was going down into Devonshire, he secreted himself in a cottage at Grantchester, near Cambridge, and read classics for twelve hours a-day, never walking out till dusk. The consequence was, that at the next trial he gained the Fellowship, and was very high, if not the very first, on the list. In 1822 he was appointed one of the tutors of the College, which post he held till 1834, when he obtained the College living of Fakenham. He died, August 5, 1855, and Churchmen and Dissenters united to pay the last tribute to his remains; for, though his college life exhibited faults of a very grave kind, to which we cannot avoid allusion, as their consequences were notorious, he gained the love and the respect of his flock as a parish priest, though the impressions

under which he commenced the discharge of his duties among them could not have been so favourable as is usual in the case of men of his academical celebrity. As a tutor, Mr. Higman was distinguished by the excellence of his lectures, and by his singular power of sufficient explanation in few words. His mathematical education had been that mixture of the old geometry and the modern analysis by which a good teacher is best formed: and the perfect clearness of his own head would not allow any confusion in the head of a pupil to escape him. One of his old pupils, now an experienced teacher, informed us that one of the most useful lessons he ever received, whether as a student or as a future teacher, was given thus. The pupil had presented a written exercise in which were the words, "It is evident," on which Mr. Higman remarked, "Mr. ———, whenever a student tells me a thing is evident, I know he doesn't see it." It is much to be regretted that Mr. Higman did not apply himself to elementary writing: he published nothing but a small (anonymous) syllabus of the Differential and Integral Calculus, which, though only a syllabus of propositions with brief remarks, will enable the reader in some measure to verify for himself the character of his teaching here given.

John Fletcher Miller, Ph. Dr., F.R.S. &c., was the eldest son of William Miller, Esq., of Whitehaven. He was born at Whitehaven in the year 1816. From his early boyhood he manifested a remarkable predilection for scientific pursuits, and immediately on leaving school he obtained a set of meteorological instruments, the indications of which he registered with undeviating regularity for a period of nearly a quarter of a century. About the year 1844 some singular facts relating to the meteorology of the Lake district of Cumberland and Westmorland came to his knowledge, which led him to enter upon a systematic and extensive examination of the subject. For several years he had from 20 to 30 rain-guages, and a number of thermometers, placed at various points throughout the lake and mountain district, and obtained results which have filled meteorologists with amazement. These results it is not our province here to discuss, suffice it to say, that they contain the only extensive observations of rain in mountain districts, and are fully discussed in a series of papers in the *Transactions* of the Royal Society.

From his youth he was ardently attached to astronomy, and was exceedingly well informed on many branches of the subject. In the summer of 1850 he erected an elegant private observatory, which he furnished with one of Cooke's admirable six-foot equatoreals. This instrument he devoted chiefly to the micrometrical measurement of a list of double stars taken from Admiral Smyth's *Cycle*. The results obtained are appended to a paper in the twenty-second volume of our *Memoirs*, by Mr. Isaac Fletcher, F.R.S., on the "Results of Micrometrical Measures of Double Stars, made at Tarn Bank." Though the stars measured are not

numerous, the results are very valuable from their accuracy, and from the fact that they relate chiefly to stars of an ascertained binary character. He possessed the elements of a first-rate observer,—excellent eye-sight, perseverance, and dexterity of manipulation.

He was well informed, also, in many other branches of science, and in anatomy and physic he possessed an amount of information which would not have disgraced a regular practitioner. He maintained an extensive correspondence with the leading meteorologists of the day, and in his early death the science of meteorology has lost one of its brightest ornaments.

He was elected a Fellow of this Society in 1849, and of the Royal Society in 1850. He died July 14, 1856.

Sir John Ross, K.T., C.B., &c., born on the 24th June, 1777, at Balsaroch, Co. Wigton, was the fourth son of the Rev. Andrew Ross, Minister of Inch. He entered the Royal Navy in November 1786, as first-class volunteer on board the Pearl, 32, Capt. Hon. Seymour Finch, and served in the Mediterranean until 1789. He was then employed in the Channel, on board the Impregnable, 98. Mr. Ross afterwards went into the merchant service, in which he remained for several years. In 1799 he sailed as midshipman on board the Weazel, sloop, Capt. William D'Urban, which vessel formed part of the expedition to Holland. In 1802 he was employed as acting-Lieutenant on board the Clyde, 38, and subsequently he served on the home and Baltic stations as midshipman in the Zealand, Kite, and Grampus, all flag-ships of Sir James Saumarez. Mr. Ross then commanded the Carteret cutter, with the rank of acting-Lieutenant, and in March 1805 was appointed Lieutenant of the Penelope, 36, Capt. Robert Broughton. He served as Lieutenant in the Surinam, Prince of Wales, 98, Hibernia, 120, Diomede, 50, and Victory, 100, all flag-ships of Sir James Saumarez. Whilst Lieutenant on board the Surinam Mr. Ross was severely wounded in the head and body, for which he was granted a pension of 150*l.* per annum. In 1808 Mr. Ross was sent on board the Swedish Admiral's ship, and acted as Captain of the Swedish Fleet. He was promoted to the rank of Commander in 1812, and appointed to the Briseis, 10, and employed on the Baltic and North Sea stations. In the Briseis, Commander Ross captured a French privateer, "Le Petit Poucet," and drove three other privateers on shore. He afterwards commanded the Acteon employed in the North Sea, and in 1815 was appointed to the Driver, also upon the North Sea station.

At the end of the year 1817 the Board of Admiralty resolved to despatch an expedition in order to ascertain the existence, or non-existence, of a North-west passage, and Capt. Ross was selected to command it. He was superseded from the Driver, and appointed to the Isabella, a ship of 385 tons, which, together with the Alexander of 252 tons, had been chosen for this voyage. The Alexander, the consort of the Isabella, was commanded by Lieute-

nant W. E. Parry, who afterwards became so distinguished for his discoveries and services in the Arctic Regions. The expedition sailed from the Thames in May 1818; after meeting with many difficulties and dangers in his progress, Capt. Ross was able to make the complete circuit of Baffin's Bay, and to return homewards in time to avoid the necessity of wintering in the northern regions.

Capt. Ross's own remarks on the fruits of this voyage are characteristic of the kindly feelings by which he was habitually animated, he says, "In re-discovering Baffin's Bay I have derived great additional pleasure from the impression, that I have placed in a fair light, before the public, the merits of a worthy and able navigator, whose fate, like that of many others, it has not only been to have lost, by a combination of untoward circumstances, the opportunity of acquiring during his lifetime the fame he deserved; but, could he have lived to this period, to have seen his discoveries expunged from the records of geography, and the Bay with which his name is so fairly associated treated as a phantom of the imagination. In 1818 I circumnavigated Baffin's Bay, and, by this means, restored to our charts, whence they had been expunged, the valuable discoveries of that great navigator whose name it bears; correcting them only where the imperfection of his means, and other circumstances, had left errors of small importance compared to what he had effected."

Commander Ross was promoted to the rank of Captain on the 7th Dec., 1818, immediately after his return from the voyage to Baffin's Bay.

His attention was constantly directed to the subject of discoveries in the northern regions. In the early part of the year 1829, with the liberal assistance of Mr. Sheriff Booth, better known as Sir Felix Booth, he purchased the Victory, a steam-vessel of 150 tons, which had been employed as a packet between Liverpool and the Isle of Man, with the intention of exploring. This was entirely a private expedition, though sanctioned by the Board of Admiralty. It was undertaken in order to solve, if possible, the question of a North-west passage from the Atlantic to the Pacific Ocean, particularly by Prince Regent's Inlet. The Victory sailed from England in May 1829, under the command of Sir John Ross, and with Sir James Clark Ross (then Commander Ross) second in command. The total number on board the Victory was only twenty-four persons. Having visited the beach where H.M. ship Fury had been abandoned, the Victory reached Cape Garry in August 1829, from whence the discoveries of this voyage commenced. Taking a south-west direction they proceeded to explore a hitherto unknown country. Owing to the ice, the shallowness of the water, the rapidity of the tides, the tempestuous weather, the irregularity of the coast, and the numerous inlets and rocks for which it is remarkable, the progress was no less dangerous than tedious. Yet they succeeded in penetrating below the latitude of 70° north, in longitude 92° west. In October

1829 their further progress was arrested by an impenetrable barrier of ice, where, however, they found an excellent wintering port, which was named Felix Harbour. The Victory was detained by the ice in the immediate vicinity of this port—there being no possibility of moving her farther than four miles during the summer of 1830, which Sir John Ross described as being beautifully fine, but extremely unfavourable for navigation.

In the autumn of 1831 they could only gain a distance of fourteen miles from the port of the preceding winter. In this harbour, which was called Victory Harbour, but which has since been named Victoria Harbour, it was considered necessary to leave their ship and endeavour to return homewards in the boats. They left the Victory on the 29th of May, 1832. The summer and autumn of 1832 were usefully employed, although the party was exposed to severe hardships and extreme danger. They reached the north-east point of America, situated in lat. 74° N., and long. 90° W.

Want of provisions and the approach of winter obliged them to make for the Fury beach, which they reached on the 7th of October, 1832, making a little more than three years from the time they passed that spot on their outward voyage. Here they were forced to remain, and this dreadful winter was passed by the exploring party in a hut they erected, about thirty-two feet long, which was speedily covered with ice, and they became, as Sir John Ross expressed it, the inhabitants of an iceberg during one of the most severe winters hitherto recorded—their sufferings aggravated by want of bedding, clothing, and animal food. The party were unable to move from hence until the 8th of July, 1833, when they set out on their return by Cape York, and Navy-Bay Inlet, near to which they had the good fortune to fall in with the Isabella, the same ship in which Sir John Ross made his voyage in 1818. From hence Sir John Ross and those under his command returned to England in the Isabella, arriving in October 1833. The courage and energy of all composing this expedition, aided more particularly by the science and perseverance of Sir James C. Ross, were the means of adding a large tract of hitherto undiscovered country to geography. It was named Boothia Felix, in compliment to the munificent patron of the expedition.

The discovery of the Magnetic Pole must not be left unnoticed. A committee of Members of the House of Commons, assisted by scientific men of eminence, appointed to investigate the results of this expedition, declared, that they saw no reason to doubt that Captain Ross nearly approached, and that Commander Ross actually reached, the Magnetic Pole.

Sir John Ross received the honour of knighthood together with the Companionship of the Bath, on the 24th December, 1834, directly after his return from this unparalleled voyage. In March 1839, he was appointed British Consul at Stockholm, where he remained several years. The following are his war services as detailed in Allen's *New Navy List.*

" Sir John Ross was Midshipman of H.M. Ship Weazel, and wounded when serving with the army in the Texel Expedition in 1799. He was severely wounded when destroying a vessel under a battery near Cape Frehel, when his boat was sunk by a shot. In a boat of the Weazel he blew up the wreck of the Jason, stranded near St. Malo. When commanding the Carteret, cutter, he was wounded in destroying a French gun-brig in the Bay of Dilcette in 1805. When Senior-Lieutenant of the Surinam he was dangerously wounded in four places, in defending a prize from the attacks of two gun-boats, under the batteries of Bilboa in 1806."

He was the author, among other works, of *Letters to Young Senior Officers, Memoirs and Correspondence of Admiral Lord de Saumarez*, and a *Treatise on Navigation by Steam*. He was promoted to the rank of Rear-Admiral in July 1851. Sir John Ross was elected a Fellow of the society in January 1821. He attended the meetings regularly, and was much esteemed by the Society for his frankness and his talents. He died in November 1856.

We have not been able to procure any details respecting the late Richard Wellesley Rothman, M.D. He graduated at Trinity College, Cambridge, with high honours, in 1823. He obtained a Fellowship, and after some years was appointed one of the two lay fellows, by which he was enabled to preserve his fellowship without taking orders. Law and medicine are the presumed studies of the two lay fellows, but Dr. Rothman complied with the founder's intention, and actually graduated in medicine. He lived mostly in college, employed in study, until about 1837, when he was appointed Registrar of the newly-founded University of London, in which post he remained till his death, which took place in the last spring. He attended especially to astronomy, and was the author of the *History of Astronomy* in the Library of Useful Knowledge,—a learned and useful work, especially in ancient astronomy, to which he had paid great attention. Dr. Rothman was a member of our Council so long as his health and avocations permitted; and was at one time our Foreign Secretary. His retiring manners and silent temperament prevented his acquirements from making any show, but those acquirements were sound and extensive, and caused him to be held in high respect by those who knew him well.

No remarkable change has been made during the past year in the instruments or the operations of the Royal Observatory. The volume of the *Observations* for 1854 has been published, and is remarkable as containing, besides the usual amount of work, two valuable appendices. One of them is the catalogue of 1576 stars for the epoch 1850, compiled from all the meridian observations made in the six years commencing with 1848 and ending with 1853. This catalogue, it is hoped, will be valuable to astronomers not only from the *number* of stars whose places are accurately

determined, but from the nature of the various classes which have been observed for particular purposes. It contains, firstly, the places of all stars in the British Association *Catalogue* from the first to the fourth magnitude inclusive, that is, it gives with great precision the places of all the conspicuous stars in the northern heavens visible at Greenwich, which may be useful for nautical, or geodetic, or other purposes. It contains, also, the places of a selected list of stars for the determination of clock-errors, additional to those given in the *Nautical Almanac*, and extending with tolerable regularity through the twenty-four hours of right ascension. Thirdly, there is a small number of stars near the north pole, which will be useful for the determination of azimuthal errors of the transit-instrument, when *Polaris* and the other close circumpolars of the *Nautical Almanac* are not visible.

The other appendix to this volume consists of the description of the reflex zenith tube, of which the principle of construction is tolerably familiar to the Fellows of this Society. Though perfect in theory, this instrument had for some time after its erection partially failed in practice from the difficulty of keeping the surface of the mercury free from disturbance, especially when the star passed the meridian during the business-hours of the day. Its first position, near the entrance-gate of the Observatory, being found particularly unsuitable in this respect, it was removed to another position a little to the west of the transit-circle room, where, it was hoped, it would be tolerably free from disturbance, and was mounted in a way similar to its former mounting, that is, with the trough of mercury resting on a slab of stone, which was itself laid upon a considerable mass of sand. It soon appeared, however, that the disturbances were not at all diminished; and, as a second experiment, a pit was dug to the depth of about ten feet, considerably below the foundation of the walls of the building. From the bottom of this pit a pier was built up quite isolated from the building, and the mercury was placed on a flat stone laid on the top of it. This arrangement did not appear to produce much effect, and for some time it appeared difficult to determine upon any mode of support likely to be successful. At length it was determined to try the plan of suspending the mercury trough from a frame having only a mediate connexion with the ground. For this purpose the well was filled with incoherent rubbish, and a stage was placed upon it for the support of the mercury trough, and by this arrangement the tremor was sensibly diminished. From this first stage was then suspended, by means of vulcanized caoutchouc, a second; and from this second in like manner, a third stage; and on the latter the mercury-trough was laid. By this arrangement the tremor was completely destroyed, but there still remained the oscillation of the mercury to be got rid of. This was effected by connecting the trough horizontally in two directions by shreds of vulcanized caoutchouc with the first or fixed stage; and by this means both tremor and oscillation of the mercury were found to have been completely got rid of. Since that

time observations have been made with perfect ease at every transit of the star when the sky has been clear, even in full daylight, and in one recent instance *γ Draconis* was observed when it passed the meridian at the same time as the sun. The instrument is now sensibly perfect both in theory and practice, and we expect from it a series of observations of *γ Draconis*, which will ultimately be of considerable value.

No alteration worthy of mention has been made in the galvanic arrangements of the Observatory, either in the application to transit-observing, or in the distribution of time. One clock at the Post-office in Lombard Street has been kept constantly regulated once every day by the normal clock at Greenwich, and the other clocks at the same office will very shortly be put in circuit. The usual operations connected with the galvanic manipulations have become very easy by the constant practice of the assistants employed, and whenever failures occur the sources of them are readily detected and corrected.

In the photographic arrangements no important change has been made, but the attention of the Superintendent of the Magnetic Department of the Observatory is constantly directed to improvements in the processes for preparing the photographic paper, and in securing still better traces of the results. An account of the whole process employed at present will be found at the end of the Meteorological Observations in the volume for 1855.

The works in connexion with the mounting of the great equatoreal at Greenwich have been progressing. The foundation-walls of the building were completed before the commencement of the winter, and in this state they have been left covered up for protection from the frost for the present. The castings for the mounting are in progress under Messrs. Ransomes and Simms, the mounting itself being somewhat similar in form to that of the Northumberland equatoreal. An object-glass of $12\frac{1}{2}$ inches aperture is expected from Merz and Son of Munich, but it has not yet been received.

The Astronomer Royal is understood to be still occupied with investigations relative to the eclipses of Agathocles, Thales, and Larissa, and to have identified the latter eclipse with the date -556, May 19. The simultaneous computation of these three eclipses, it is hoped, may prove valuable both for astronomy and for the geography of ancient history: inasmuch as the enchainment of the three eclipses by one system of solar and lunar tables not only requires certain possible corrections (of minute amount) to the elements of the tables, but also defines with some degree of accuracy the limits of the districts over which the shadows must have passed.

The formation of standard end-measures from standard line-measures has been accomplished in a perfectly satisfactory way, by taking advantage of an ingenious suggestion of Mr. W. Simms, jun. The Society will be glad to learn that the essential parts of this troublesome work are now completed. An apparatus has been

prepared for the Exchequer Office for verifying with very considerable exactness the divisions of ordinary divided scales, on several systems of subdivision: and another apparatus is in hand, for the same office, for testing with a degree of accuracy that has never been attempted there, the correctness of the total length of end-measures.

At the Radcliffe Observatory the principal work during the year has been the continuation of the Catalogue of Remarkable Objects, which was begun in 1854. The Circumpolar Catalogue is quite finished, but it has been thought desirable to annex to the comparison with Groombridge the mean dates of his observations. Groombridge's manuscripts have been some time in Mr. Johnson's hands, and the dates have been nearly all copied. The sixteenth volume of the Radcliffe Observatory will appear in the course of a few weeks.

At Cambridge Professor Challis has prosecuted as formerly the observations of the small planets and of zodiacal stars. He has continued his attention to the adjustments of the transit and mural circle, with the view of eliminating by optical means the errors due to changes of the material. Since the publication of the Report Mr. Challis has communicated to the Editor of the *Astronomische Nachrichten* his intention to observe more particularly a selected number (eight) of the minor planets, following in this respect the course taken at other observatories. By this arrangement the distraction of having to attend to several at the same time is avoided; but it is not found that the labour of observing is much lightened, as the selected few are pursued into difficult positions in order to get as large a number of observations as possible.

Last autumn he again went through a series of measures (which is intended to be annual) to eliminate the effect of the forms of the transit pivots. The result accorded with those before obtained, and afforded additional evidence of the necessity of getting rid of this source of error prior to any exact determination of terrestrial longitude.

He also completed, last autumn, a series of determinations of the effect of flexure of the large mural circle, for positions of the telescope separated by intervals of 5° and 10°. This set was taken after particular precautions were adopted to get rid of any effect of variations of temperature, so that the measured effect might be solely due to flexure. The maximum angular amount was scarcely more than $0''{\cdot}5$, which is less than the amount given by direct and reflexion observations of stars. Mr. Challis thinks that in the latter method the sudden change of position of the circle, combined with variations of temperature from point to point, has some effect. He proposes, as soon as he can get time, to communicate to the Society the details of this experiment, which he believes is of a novel kind.

Mr. Challis has recently presented to the Society a collection

of the Reports made by the University Syndicate on the Observatory, from the beginning of his tenure of office. These Reports will in future be presented at the time of printing. They may, perhaps, have been hitherto kept back as being considered only of local importance. But the Council would remind all who are connected with any serial publication on astronomy, that such publications will be in time future, as they now are for time past, the only means of settling points of history, and the links between statements, of which the connexion would otherwise be difficult, or even impossible. All such publications ought to be preserved in the Society's library.

At Edinburgh the volume of Observations to the end of 1854 is completed, and will soon appear. A second assistant—an addition to the observatory much wanted and long expected—will probably soon be appointed. The history of the Edinburgh Observatory for the past year would be incomplete without special notice of the remarkable expedition to Teneriffe, made by Professor Piazzi Smyth, in the course of last summer. Of the energy displayed in this undertaking, the Council cannot speak too highly; nor can they doubt that the results will be valuable and lasting. The following brief notes will be most interesting to the Society, which, in common with the public at large, has had as yet but little information, owing to the official necessity of waiting until the account of the whole had been forwarded to the Admiralty. Professor Smyth is desirous of repeating his work. The Captain-General of the Canaries has written to express his full approbation and good wishes: and Mr. Stephenson and others have volunteered to repeat the loans which so largely contributed to the past success.

The origin and object of this expedition were first noticed in the Report to the Board of Visitors, by the Astronomer Royal for Scotland, in November 1852.

The plan was recommended by the Astronomer Royal (G. B. Airy) to the Admiralty in March 1856, and at once allowed by Sir C. Wood, the First Lord, on this footing, viz. that Professor Smyth should be furnished with a certain sum of money, and should be left to carry out in his own way the novel sort of inquiry of "How much can Astronomical Observation be improved by the Elimination of the lower third part of the atmosphere?"

Sir C. Wood and Captain Washington (hydrographer) behaved most liberally to Professor Smyth. His first estimate of the sum required was 300*l.* He was asked if that was not too small a sum: and being further advised to take out a larger and better telescope than the one at first contemplated, he sent in a new estimate for 500*l.* This increased sum was *instantly* placed at his disposal, with the only injunction that it was not to be exceeded. The conduct of the Board of Admiralty requires no praise at our hands, and we are confident it will be appreciated by public opinion.

April and May 1856 were spent in making preparations. Meanwhile lists of suggestions for all sorts of additional observations over and above those of the expedition, came in from different scientific societies and individuals, through the Admiralty, enough to entail the carrying out of many observers, and the expenditure of much money. But Professor Smyth determined to abide by his promise not to exceed his estimate. Nevertheless he was anxious to do something for the suggesters, and was in great straits until he was enabled to extend his operations, without further expense to the Admiralty, through the liberal loans made to him for the service of the expedition by various private individuals, namely:—

1. Actinometer, magnetometer, two radiation thermometers, electrometer, spectrum apparatus, and polarimeter. By G. B. Airy.

2. Grand equatoreal, telescope 12-feet focal length, 7·5-inches aperture, with clock motion, &c. By H. L. Pattinson, Esq. of Newcastle-on-Tyne.

3. Quartz train for spectrum. By Prof. G. G. Stokes.

4. Mountain barometer and six thermometers. By Dr. Lee of Hartwell, who also offered a large telescope, but it was declined, another being already supplied.

5. Mountain barometer, and four thermometers. By J. Adie, Esq. of Edinburgh.

6. Thermomultiplier. By J. Gassiot, Esq.

7. Four barometers, twelve thermometers, and hydrometers, with blank books and maps. By Captain Fitzroy, on part of Board of Trade.

8. Four chronometers. By the Hydrographer to the Admiralty, Captain Washington.

9. Double sextant. By Admiral Beechey.

10. Polarization appliances. By the Rev. Baden Powell.

11. Plane speculum. By J. Nasmyth, Esq. C.E.

12. Eye-pieces and adaptations to equatoreal. By T. Cooke, Esq., of York.

13. Lastly, by R. Stephenson, Esq. M.P., was made the loan of his yacht the Titania, of 140 tons, and with a crew of sixteen men, for the voyage out and home, and during the whole period of the expedition. "Four months," said he, "do you expect to be away; well, then, I will send down this evening an order to the captain to have provisions for that time put on board; and the yacht shall be ready to sail at any time you like on twelve hours' notice: and when you get to Teneriffe you can take any of the men who can be useful to you up the mountain."

And Professor Smyth acknowledges with pleasure, that for the whole four months the captain and crew followed out in letter and spirit Mr. Stephenson's instructions, that they were to attend to Professor Smyth as though he were Mr. Stephenson.

Sundry other instruments were furnished by the Edinburgh

Observatory; amongst them the 5-foot equatoreal presented some years ago by the late Rev. R. Sheepshanks.

The best thanks of the astronomical world are due to Lord Clarendon for his passports, and his letters to the officials connected with his department abroad; and to the English Custom-house Officers; also to the Spanish Ambassador, Don Antonio Gonzales; and to Admiral Manners, for letters of introduction and recommendation to the Captain-General and many in authority at Teneriffe.

Professor Smyth set sail in the Titania on the 24th of June, with the run of the whole yacht, excepting those cabins in which were stowed his seventy-nine packages of instruments and camp-equipage.

On the voyage his "free-revolver" stand for a telescope at sea was tried, and found perfectly successful, a distant object remaining bisected in the field of view under any amount of rolling and pitching of the vessel: the sailors saw and confessed the powers of the new apparatus, and took kindly to it.

He arrived at Santa Cruz, Teneriffe, on July the 8th. From thence the yacht carried the goods round the island to Orotava, the most convenient port for the Peak.

The lowlands of Teneriffe were found to be bad for astronomical purposes by reason of the abundant clouds of the trades, and the violence of the wind in many parts.

From July the 14th to August the 20th he occupied Mount Guajara (28° 12′ N., 16° 38′ W.) 8843 feet high, his party including the carpenter and the second mate of the yacht, besides sundry Islenos.

They found themselves there above the trade-wind cloud, and all the cumuli, cumuloni, and cumulostrati, which appear daily below. But they were not above the thinner sorts of clouds, as cirri, cirrocumuli, and some cirrostrati, which appeared about one day in five.

The mountain sky was therefore very favourable as regards freedom from clouds. The climate was also remarkably free from wind, for a mountain-top, by reason apparently of its being nearly between the line of "wind and water" of the lower N.E. and the upper S.W. winds. The temperature was moderate, from 70° by day to 40° at night. The dryness was excessive, both by night and by day; a depression of the dew-point to the extent of 50° was not unusual, 56°·4 has been observed; 40° was an average quantity, and less than 30° was rare; and all this when the lower country and the sea around were covered in by a dense bed of clouds. The electricity was always resinous, and never abundant. The radiation of the sun was fierce, mounting above the graduation of the instruments, and with the temperature reading $180° + x$; without the temperature it was $110° + x$, and the value of x may be 10°, or may be 20°. The progress of radiation was sometimes observed at 15-minute, sometimes 5-minute, and sometimes 1-minute intervals throughout the 24 hours. Radiation with

the moon was perfectly sensible to the thermomultiplier without any other condensation than the little cone usually applied to such instruments.

Under these climatic conditions the Sheepshanks equatoreal was erected, and was found to have its vision greatly extended and improved. In Edinburgh, with *α Lyræ* nearer the zenith than in Teneriffe, Professor Smyth had never been able to see the companion (11 mag.); but at the Guajara station it was always visible, and the following smaller stars were also seen:—

C of	5 Aquilæ	14 mag. tabular.
D of	13 Lyræ	13 —
B of	128 Anseris	13 —
C of	185 Antinoi	12 —
B of	307 Aquilæ	13 —
B and C of	B Equulei	13 and 14 mag.

Definition was equally improved; such disks and rings were seen almost every night as had never been witnessed on any occasion in Edinburgh.

The increase of the black lines in the spectrum was remarkable as the sun's zenith distance increased: there was a growth of the red end of the spectrum; the definition of the lines improved, their numbers multiplied, and their thickness and blackness increased; with this feature, that certain lines remained constant, though amongst others that varied.

The horizon line of the sea was never seen; the sun invariably rose and set behind the line of the N.E. trade-wind cloud, and this had a zenith distance of 91° 11′. The zodiacal light was regularly observed, but not with confirmation of recent theories.

The improvement of astronomical vision was on the whole ascertained to be greater than had been generally expected from an elevation of 9000 feet, owing apparently to the lower strata of the atmosphere being contaminated with dry dusty particles of matter and having been in so far surmounted.

This dusty medium, however, does not terminate at 9000 feet; and was found to be so inveterate an interferer with the transparency of the air, that it was determined to try a higher station.

A second station (Alta Vista, 28° 16′·5 N., 16° 38′ W.) was therefore chosen with this view, and was occupied from August 21 to September 19: it was situated on the slopes of the Peak, at 10,710 feet above the sea; at a depth below the Peak of 1500 feet; was surrounded on three sides by steep-sided lava streams, and was the highest point possible to be reached without the expenditure of much time and money in removing obstructions. The following are notes of the circumstances that were found to prevail there.

Climate—Temperature 56° to 38°. *Dryness*—Depression of

the dew-point, maximum 46°, average 30°, minimum 18°; less therefore than at first station.*

Radiation of the sun greater than at the first station, and $= 128 + x$ or above graduation of instrument; with temperature $= 177° + x$, x being $= 10°$ or 20° or more, and this so early each day as 9^h A.M.

In this locality the great Pattinson equatoreal was erected.

For space-penetrating power stars of the 16th magnitude, as *b Equulei*, were easily seen.

For definition and separating power nothing in the way of distance, except it were less than a second, was deemed worthy of any attention.

The closest of the whole that was thus observed was B of *γ Andromedæ*, the components were seen thus night after night, *i. e.* there was a dark line between them, but the disks were somewhat compressed on that side. The last night it was so observed it was at an hour-angle of $4^h\ 35^m$.

Twenty double stars were observed at this station for definition and vision, and thirty-four for colour.

The sun's limb was frequently examined for red prominences both with the Sheepshanks telescope fitted up with Nasmyth's "bag," and with the Pattinson equatoreal supplied with other contrivances. Only once, however, was there any appearance of success.

The zodiacal light, twilight, and the spectrum, were again made subjects of observation, until the season broke up completely on the 14th of September, a month before the usual period; and the party abandoned the station on the 19th.

It was sufficiently demonstrated, however, that improvement of astronomical vision between 9000 and 10,700 feet is very sensible. But inasmuch as even that latter height is transcended by the upper regions of the "dust-haze," it would be highly desirable to try a higher station still. The culminating point of the Peak itself is not suitable, by reason of the hot and sulphurous vapours always escaping from the crater there; but on examining the upper part of the mountain distant from the crater, a site for a station was found at 11,700 feet, far removed from any immediate cause of the persecuting dust, and accessible to mules if a little money be spent in road-making amongst the lava blocks of the Malpays.

Such a station would be easy to occupy in summer, and would enable many important observations to be procured. It might not still be high enough for the red prominences; but it would be well to try it before going farther, as the next mountains which are higher, and at the same time practicable for observatory work, are the Andes on one side, and the Himalayas on the other,—both too far off to be compassed by a mere summer expedition.

* In the towns at the level of the sea the depression of the dew-point was only from 5° to 10°.

At Liverpool, the principal general astronomical work has been the observation of the new planets, when first discovered. Mr. Hartnup is more than ever employed in the special business of his institution. In his last report, he states that a greater interest is now taken in what he is doing; and that from the mass of evidence, which the records of the Observatory now furnish, he is able to make the utility of the institution very clear to naval visitors. Under the direction of the Board of Trade, azimuth compasses have been furnished gratuitously to a considerable number of ships, on condition of the commanders returning a record of the observations made for the correction of the steering compasses. Arrangements are now made for testing the barometers and thermometers used at sea,—and not before it was wanted, seeing that Mr. Hartnup finds an error of from half an inch to an inch to be no uncommon matter in the reading of the barometers used in the merchant service. Some papers by Mr. Hartnup, printed in the *Transactions of the Historic Society of Lancashire and Cheshire*, and treating of the corrections of chronometers and meteorological instruments, show both Mr. Hartnup's activity in his most peculiar business, and the success of his efforts to excite attention to the subject.

We may at length congratulate the Madras Observatory on the prospect of being furnished, by the liberality of the Court of Directors, with a new meridional circle, which has been already ordered of Mr. Simms, and which, it is hoped, will materially increase the efficiency of the Observatory, and enable it to take up the minor planets, for which class of observation it seems particularly qualified by geographical position. Awaiting the arrival of the new instrument, nothing of importance in the way of meridional observation has been attempted with the old ones, now nearly worn out. Capt. Jacob resumed charge of the Observatory on 29th December, 1855, and recommenced observations with the equatoreal, which had been nearly suspended during his absence. The work done during the past year has been chiefly measures of a few of the principal double stars, among which α *Centauri* holds a conspicuous place, the components having now an angular motion of nearly 15° per annum; also physical observations of *Mars* and *Saturn*, and measures of *Saturn's* ring and satellities. We regret to learn that Capt. Jacob's health is again failing, and that there is little hope of his being able to remain much longer at his post.

At Redhill Mr. Carrington brought the observations of position for his circumpolar catalogue to a conclusion on the 20th of September last, and the reductions to apparent place were not more than ten days in arrear of the telescope. On summing up, it was found that the total number of observations for the catalogue amounted to 13,110. The first two sections were finally arranged and cleared of the ordinary errors of recording in the

month of June previously, and now require only a last critical examination. For the third and last section the corrections to mean place are computed, and are being worked the second time previously to application. This section will, accordingly, be also finished in about six or seven weeks.

A very valuable work has, during the year, emanated from the Vienna Observatory, the reduction by M. Oeltzen of the circumpolar star observations of Prof. Schwerd of Speyer, and has been welcomed as a very acceptable arrival at Redhill. That catalogue affords well-determined positions for the year 1828 of about 690 of the brighter stars included in Mr. Carrington's region. It was obviously indispensable that the positions of Schwerd should be brought up to 1855, and compared with those determined at Redhill, previously to the publication of the latter. Concluded mean places were therefore formed from the single observations given by M. Oeltzen, and the whole brought up to the year 1855, with Peters' constants of precession, and the formulæ of Bohnenberger, given by Bessel in his *Tab. Regiom.* This process, which was one of no great labour, is also finished, and the partial comparison hitherto instituted has shown a very satisfactory degree of accordance between the two authorities. So soon as the comparison can be made general, reference will be made to M. Oeltzen respecting the errors detected in Schwerd's places, many of which depend on single determinations. By this means the modern positions of the more important stars will be accompanied by pretty close approximations to their proper motions.

There remain, then, at the date of this Report, about six weeks' work for the completion of ordinary reductions, the arrangement of the whole, the dressing down the estimated magnitudes to the scale of our standard observers, and the reworking of the maps. It is a little difficult to estimate the precise time which will be necessary; but it will probably not much exceed three months.

The solar spots have been observed and treated precisely as during the past two years; but the discussion of the positions observed is still postponed for the present.

The past year also witnessed the inauguration of another first-class observatory in the United States, at Albany, the capital of the State of New York.

This institution is due to the munificence and public spirit of a few individuals in that city, especially to that of a lady, Mrs. Dudley, by whose name it is to be called.

This lady, who henceforth takes a place among the chief benefactors to astronomy, has presented the munificent sum of $64,500, (exceeding 13,000*l.* of our money); of which $14,500 are to be appropriated to the acquisition of an heliometer of the largest size; and the remaining $50,000 are to form part of the maintenance fund of the observatory.

The heliometer will be made by Mr. Spencer, an American

artist, whose reputation as a maker of microscopes has been long established.

The other principal instruments are to be a transit and a meridian circle, also of first-class dimensions. The circle, by Pistor and Martins of Berlin, has, we believe, already arrived in the States.

The American, or, as it is now called, the Chronographic system of registration, is to be extensively applied, and the apparatus for this purpose is said to be of great excellence.

The direction of the new observatory has been offered to our associate, Dr. Gould of Boston, in whose hands its magnificent appliances, we are sure, will not be allowed to remain idle.

During the past twelvemonth the minor-planet group has received an accession of four new members, making the present number of these small bodies *forty-two.*

Lætitia was discovered by M. Chacornac, at the Imperial Observatory, Paris, on the 8th of February.

Harmonia, by Mr. Herman Goldschmidt, on the evening of March 31st.

Daphne, by the same observer, on the 22d of May. The elements of this planet are hardly determinable from the few observations that were procured, the opposition being far passed at the time of discovery. It is not unlikely that considerable difficulty may be experienced in detecting the planet again, though the ecliptical star-maps now in the possession of astronomers will afford a ready means of watching the minute stars in the vicinity where it may be expected to show itself.

The fourth planet, named *Isis* on the suggestion of our President, was found at the Radcliffe Observatory, Oxford, by Mr. Norman Pogson, on the 23d of May. It should not be forgotten, in forming an estimate of Mr. Pogson's zeal and diligence as an observer, that it is only during his leisure hours, after the regular duties at the Observatory are ended, that he is able to pursue the search for new planets by star-mapping and systematic examination of the heavens in the region near the ecliptic.

Vague notices have appeared in the newspapers with reference to a comet seen on the coast of Peru, in August last, and another visible in the north-west sky at Panama early in January; but no observations of either have yet been published. There is some probability that the comet of August was remarked on the 7th of the month, at Beeston Observatory, near Nottingham, according to a note issued by Mr. Lowe: the object, supposed to have been a comet, was situate in the constellation *Virgo*. It is much to be desired that, if any one has been fortunate enough to secure positions of either comet, however rough they may be, he will make them known.

The recent occultation of *Jupiter*, and the exhibition of the private forces of astronomy which it has drawn out, gives the

Council the opportunity of suggesting to private observers one or two points to which their attention may be usefully directed. Private individuals, possessed of fine instruments, need not be content with the verification of known facts and the observation of predicted phenomena. In astronomical observation, as in other things, there are those who are diffident of their own power to originate, and who content themselves with showing, in matters which they are not afraid to touch, all the industry and all the sagacity which would have given them the best chance of success in actual extension of our knowledge.

In the first place, there is comet-seeking. It would give the Council much pleasure to know that several of the unprofessional members of the Society made a practice of watching selected portions of the heavens for the passage of these bodies, and of learning readily to distinguish between them and the nebulæ. Our German friends have hitherto—and all praise to them for it—received most of the King of Denmark's medals, and this country has taken comparatively little part in thus watching the skies. May we hope to see the professional observer occasionally fed with a comet by our private searchers? The pursuit is peculiarly one in which a telescope may be usefully taken up for an hour or two and put by again.

Photometry again still offers very much for research: but to pass on to another subject, we may remind our members that no one has at present produced on our table a photographic image of a fixed star. A good or even a moderate photographic image of a group such as the Pleiades would be something we have not yet had the pleasure of seeing; and a fair approach to getting an instantaneous image of a group of faint points might lead the way to results of great importance. It may be long, or it may not be long, before we have to add a column of actinic magnitudes to our catalogues, and replace the human retina by a surface still more sensitive to luminous impressions.

In the sixteenth volume of the *Notices* of this Society (page 178), is an abstract of a paper by Professor Plana, on some corrections necessary to be applied to some of the terms of the fourth order in the analytical expression for the secular acceleration of the mean motion of the moon, in which he appears to recognise as confirmed a correction in the coefficient of m^4 previously detected by Mr. Adams.

In June 1856 he read before the Academy of Sciences at Turin another paper, of which we propose to give a short account, in which he appears to have considerably modified his views with regard to these corrections, and, with the exception of the coefficient of m^4, he considers as confirmed all the coefficients to the fourth order, found in the expression for the secular acceleration as given in the first volume of the *Théorie de la Lune.* Several terms of the fifth, sixth, and seventh orders he points out as necessary to be added; but the chief circumstance to be remarked is that the

correction, which he now states to be necessary to the coefficient of m^4, is not that found by Mr. Adams, but has a totally different value. For the sake of clearness we will give all the values which have been attributed to this coefficient:—

That given in the *Théorie* is	$-\frac{2187}{128}$
Adams's coefficient (confirmed by Plana in his previous memoir) is	$-\frac{3771}{64}$
Plana's new coefficient is	$-\frac{351}{64}$

Throughout the whole of the memoir under review M. Plana makes no allusion to the researches of Mr. Adams, except in a note, in which he remarks, that if two terms, which it is absolutely necessary to keep separate, and one of which cannot enter into the expression for the secular acceleration, be added together, the coefficient found by Mr. Adams will be derived. This want of reference to preceding researches (for his own previous memoir is barely mentioned with reference to the typographical error discovered in Vol. I. of the *Théorie*), produces some obscurity in the present memoir, and we can only assume that he wishes the investigation now before us to be substituted for the one previously given, in which Mr. Adams' correction appeared confirmed.

All that can be done then, in a brief account of this elaborate paper, is to state the chief results which are now apparently considered to be definitely settled, and to quote a few passages giving the views of M. Plana, and his reasons for their adoption.

It has been stated that the coefficient of m^4 now arrived at is, $-\frac{351}{64}m^4$. Adopting this term, substituting the corrections indicated in the terms of higher orders, and calculating all the numerical coefficients anew, M. Plana finds that the principal term in the acceleration (that is, the term to be multiplied into the square of the number of centuries) is $11''{\cdot}51157$. This value he finds to satisfy very well several well-known ancient eclipses, amongst which he specifies that observed at Babylon in the year 720 B.C., and that of Theon at Alexandria in the year 364 B.C.

The following passage expresses, perhaps, more clearly than any other in the memoir, his views with regard to the necessity of rejecting one of the terms which together make up Adams's coefficient of m^4.

"In considering separately the part of the secular equation of the mean motion of the moon, which, by a particular combination, gives rise, by virtue of integrations, to periodical terms multiplied into the differential coefficient $\frac{de'}{dv}$ of the secular variation of the excentricity of the earth's orbit, we should obtain a quantity, which by its form appears as if it must be an integral part of this same equation. But, in examining more closely the origin of this part, I have found out that its addition to this primitive part is inadmis-

sible." He then gives the complete expression containing all the terms which would be thus improperly introduced, the principal of which is $-\frac{855}{16}m^4$, and continues: "In calculating the following terms, we should reduce the coefficient of the secular equation to such a degree of minuteness that it would be incompatible with observations both ancient and modern. At the same time, independently of this indirect consideration, it can be demonstrated, that the complete suppression of this part is required by the method even of the successive approximations, on which is founded the whole of the theory which furnishes the coefficients of the lunar inequalities."

In a following section of the paper he proceeds to demonstrate the proposition which he thus lays down, but the reasoning is of too analytical and abstruse a character to be introduced here. Probably enough has been given to show M. Plana's opinion of the present state of the controversy respecting the values of the coefficients of the terms of the secular equation of the mean motion of the moon, and also to show what corrections must be made to the results of the *Théorie* and of his memoir preceding the one under consideration, to represent those which he now substitutes for them.

Amongst the astronomical works of which it is incumbent on us to take notice, probably the most remarkable are the two first volumes of the *Annales* of the Paris Observatory, published rather more than a twelvemonth ago by Le Verrier. Though published at the end of 1855, but few copies have found their way into this country till very recently, and this may account for the tardiness of the notice which we now propose of the work.

It is printed in two large quarto volumes, containing about 400 pages each, and contains certainly the most perfect and the most concise system of modern theoretical and practical astronomy extant, and a very brief statement of its contents will convince any one tolerably conversant with astronomical operations that it must ultimately come into general use amongst astronomers, and will probably occupy that place which up to this time has been retained by the *Tabulæ Regiomontanæ* of Bessel.

The three most important divisions of the book are, 1st, the introduction; 2d, the application of pure mathematics to the most important of the processes of spherical and physical astronomy; and 3d, the recalculation of the greater number of the tables of the *Tabulæ Regiomontanæ*, founded on a new discussion of the places of Maskelyne's 36 fundamental stars, by help of the best modern determinations of the constants of reduction.

To begin with the introduction. In this, the chief object of Le Verrier is to show what organisation and what development must be given to the Paris Observatory to enable it to take for the future an honourable part in the various classes of observations which the present extension of the science of astronomy has intro-

duced, and in the cultivation of the other sciences to which it has become so intimately allied. In doing this he traces historically the rise and progress of each branch of observation, the various improvements which at various epochs it has received, and the state to which it has arrived at the present time, both with regard to instrumental means and to improvements in methods of observing. And one remarkable fact is elicited which it is worth while to attend to, that, since the middle of the last century, when Bradley commenced his admirable series of observations, the observatory of Greenwich has been uniformly improving both the instruments and the methods of observation, and has with undeviating regularity pursued those classes of observations which are necessary for establishing the fundamentals of astronomy, while the Paris Observatory has never, since the time of the Cassinis, taken any prominent part in the improvement or development of the science. Undoubtedly the object of the author is to place the contrast between the remissness of the French national observatory and the activity of foreign establishments in as strong a light as possible, for the purpose of inducing the French Government to provide on an adequate scale for the future development of the institution, according to the enlarged and philosophical views which he has so admirably laid down. Still, it is gratifying to find that in the proposed organisation of the observatory, reference is almost always made to Greenwich, as presenting the best existing model for carrying out the proposed plans of extension and reform.

He sums up briefly at the end of the introduction, the chief articles of the reform which will be necessary in the Paris Observatory to put it in a condition to compete successfully with Greenwich and other great European observatories, and to play the part which he thinks absolutely necessary in the existing state of the science.

His chief recommendations are the following:—To repair the existing instruments and to provide others which are necessary, including a large transit-circle and a galvanic apparatus for recording transits and for distributing time. To establish the great equatoreal which is already in course of preparation. To organise a computing-staff for the reduction of observations, and especially to provide for the reduction of all observations made since 1847. To pursue, in common with the Marine administration, the means necessary for rating chronometers both at Paris and at the ports, for extensive distribution of precise time, and for new and accurate determinations of longitudes. To make provision for the regular study of the great questions in physical astronomy. To organise a system of meteorological observations and research. And, lastly, to provide accommodations for the observers, and the requisite funds for carrying out all the specified objects.

The book itself contains an admirable collection of almost all the formulæ which are necessary in the whole range of astronomy, together with many elaborate tables belonging to the different

divisions of the science. The first part, included in the introduction, is devoted to such portions of pure mathematics as are most frequently required. Setting out with circular functions and plane trigonometry, he discusses in succession the doctrine of spherical triangles, series, interpolations, method of quadratures, the resolution of equations of condition according to the method of least squares, &c. Proceeding then to spherical astronomy, he treats of geocentric and heliocentric co-ordinates and the transformation from one set to the other, the theory of the planetary and cometary orbits (adding a table for parabolic motion), and other similar subjects. He then proceeds to physical astronomy, and explains fully the application of the variation of parameters to the orbits of the disturbed planets. In another chapter he discusses the development of the disturbing function, giving tables for particular planets, and treating at considerable length of the great inequality of *Pallas*. The remaining subjects of this portion of the work, are, the discussion of perturbations of the second order with regard to the masses, the doctrine of the secular inequalities of the planets, and the definitive elements of the eight principal planets. This part is concluded with a very elaborate discussion of precession and nutation.

The third division of the work is devoted to the positions of the fundamental stars; and it is this portion which will be perhaps best known and most useful in the ordinary processes of practical astronomy. By means of the formulæ, given and discussed with admirable precision at the commencement, including those for reducing the position of a star from one epoch to any other, he gives a table of the mean right ascensions and mean declinations of Maskelyne's 36 fundamental stars for the epochs 1755 and 1845, the former resulting from his rigorous and independent reduction of Bradley's observations, and the latter from a severe discussion of the modern Greenwich observations since 1836.

He then gives in detail the successive steps of his reductions of Bradley's observations, and his discussion of the modern Greenwich observations, and concludes the work with a series of tables similar to those of the *Tabulæ Regiomontanæ*, including all the elements of reduction necessary for finding the apparent places of the 36 fundamental stars for any day between the year 1750 and the year 1900.

The preceding account may serve to awaken the interest of astronomers, and to induce them to study its contents. It is equally well adapted for the uses of the university or of the observatory; and, while it is invaluable to the practical astronomer, parts of it might with great advantage be introduced into our schools and colleges, where the higher branches of astronomy are taught; and the author would be doing a serviceable work if he would provide for its publication in an octavo form, with such retrenchments as would enable it to fulfil the purpose of a handbook of astronomy.

The subject of Oriental astronomy is one which demands peculiar literary qualifications, and very few are able to advance or correct existing European knowledge of it. A very interesting addition to this part of the subject has been made by Mr. Wm. H. Morley, who has devoted much time, research, and money, and a familiar knowledge of the Oriental tongues, to the illustration of the astrolabe, the great instrument of the East. Under a title which professes no more than to describe an astrolabe made for the Sultan Husain Sufawi, and preserved in the British Museum, he has gone deeply into the details of this instrument, its construction, use, and history, the knowledge of it in Europe, and the varieties of it known to exist. The plates are taken by the anastatic process from the instrument itself, which is thus copied to the life. Advantage has been taken of the size thus rendered necessary to produce a gorgeous specimen of typography. Ample citations are given from original writers in Persian and Arabic, and the work is thus as complete a monograph as has ever been given to the world. That very few can fully avail themselves of Mr. Morley's labours does not lessen his title to our gratitude; the future historians of astronomy will not deserve the name if they do not avail themselves of the means of accuracy which he has placed within their reach.

The Society will be glad to be informed that the printing of the new Lunar Tables by Professor Hansen is proceeding rapidly, at the expense of the British Government, and under the immediate care of the Astronomer Royal. Professor Hansen came to Greenwich to superintend the commencement of the work, and himself revised the elaborate introduction, which contains a careful exposition of the formulæ and tables. The work, when completed, will form a large quarto volume, nearly as thick as a volume of the *Greenwich Observations*. It is understood that Professor Hansen will shortly publish the Theory on which the Tables are based.

While speaking of the works of Professor Hansen, we would also draw attention to a short paper by him recently inserted in our *Monthly Notices*. In Cicero's book *De Republicâ* is an obscure quotation from Ennius relating to an ancient eclipse which took place in his time. Professor Hansen has succeeded in identifying this eclipse with the date, and thereby fixing the technical chronology of the Roman months at this remote period of history.

We cannot pass without a word of congratulation a notice which has recently appeared of the present labours of Professor Argelander. Our experienced associate is still pursuing his steady course of approximating to a more and more perfect knowledge of the contents of our European skies; and in this projected atlas of the northern hemisphere, which he reckons on completing by the year 1862, and in which he designs to comprise every star in the first 9 magnitudes, we see another step in advance worthy of his

antecedents. The meridian observer will thus be furnished with an ample working catalogue, and the chart-maker with a basis for maps of the greatest elaboration. It may appear rather strange at first, that for several years the principal work of the magnificent establishment at Bonn should be performed with a little telescope of 34 lines aperture, and that no refinement of observation or reduction should be aimed at beyond what is necessary for chart-positions; but knowing, as we do, the requirement which exists of extended knowledge of the region to the north of the much-cultivated ecliptic, we applaud Professor Argelander's resolution in renouncing for a time work of more pretension for this proposed survey.

In the forty-fourth volume of the *Astronomische Nachrichten*, Nos. 1040–2, is an elaborate paper by Mr. Marth, of the Durham Observatory, entitled "Researches on Satellites," to which we are desirous of directing the attention of the Society.

The writer proposes in this and succeeding memoirs to investigate the motions of the satellites of *Saturn*, *Uranus*, and *Neptune;* but, in the present instance, he has confined himself to the preliminary mathematical investigations which are necessary. In the first portion of the paper he deduces the formula by which the apparent positions of the satellites referred to the planet, either by means of angular distance and position-angle, or by differences of right ascension and declination, may be calculated from given elements and given places of the planet; and by which likewise the equations of condition may be found which exist between variations of the positions and corresponding variations of the elements. He then shows how to determine the approximate elliptic elements of the orbits which are to be used in the calculations; and he, lastly, takes into account the disturbances introduced by the action of the sun and other bodies.

He promises, in succeeding memoirs, to give the results of his numerical researches on the orbits of the satellites of *Saturn*, *Uranus*, and *Neptune*.

Papers read before the Society from February 1856 *to February* 1857.

1856.

Mar. 14. On the Rings of *Saturn*. Signor Secchi.
Occultations of Stars by *Saturn*. M. Winnecke.
On *Saturn's* Rings. Mr. De La Rue.
Elements of *Leda*. Mr. Pape.
Description of an Observatory. Mr. Brodie.
Observations of Solar Spots. Capt. Shea.
On the Meteor of January 7, 1856. Dr. Mann.

Discovery of a New Planet. M. Chacornac.
On the Rings of *Saturn*. Capt. Jacob.
Observations of Minor Planets at Greenwich. The Astronomer Royal.
On certain Anomalies in the Orbit of *α Centauri* and on the Rings of *Saturn*. Capt. Jacob.
Observations of Minor Planets. The Astronomer Royal.
On the Solar Spots. Capt. Shea.
Plan proposé pour l'Etude du Magnétisme Terrestre. M. Laugier.

April 11. On the Outer Ring of *Saturn*. Mr. Watson.
On the Appulse of a Star to *Saturn's* Ring. Rev. W. R. Dawes.
Occultation of *Antares* by the Moon. Mr. Breen.
Do. do. Rev. W. R. Dawes.
Do. of Stars by the Moon. Capt. Shadwell.
On the Dimensions of the Bright Ring of *Saturn*. Dr. Kaiser.
On the Value of the Diameters of *Mercury*, *Venus*, &c. Rev. R. Main.
On the Conjunction of *Jupiter* and *Saturn*, B.C. 7. Rev. C. Pritchard.
Description of Observatory at the Collegio Romano. Signor Secchi.
Experiments on Solar Radiation. Prof. C. P. Smyth.
Occultation of *Antares* by the Moon. Mr. Whitbread.

May 6. Observations of Minor Planets. The Astronomer Royal.
Catalogue of Double Stars. Mr. E. B. Powell.
Measures of *Saturn's* Rings. Mr. De La Rue.
Note on Variable Stars. Mr. Wackerbarth.
Description of an Observatory at Tulse Hill. Mr. Huggins.

June 13. Observations of Minor Planets. The Astronomer Royal.
Do. do. Cambridge. Mr. Breen.
Results derived from an Examination of certain Places of the Five principal Planets on Four Egyptian Tablets. Mr. Ellis.
Observations of *Isis*. Mr. Pogson.

July 11. Occultations. Capt. Shadwell.
Do. Lieut. Dayman.
Telescopic Appearance of *Mars*. Mr. Brodie.
On the Period and Changes of *α Herculis*. Mr. Baxendell.
On the Variability of 13 *Lyræ*. Mr. Baxendell.
Occultation of *Antares*. Mr. Burr.

Nov. 14. Longitudes derived from Solar Eclipse, Nov. 19, 1854. Rev. R. Main.
Results of Observations of Small Planets. Mr. Airy.
Observations of Klinkerfues' Comet. Mr. Maclear.
Geocentric R.A. and N.P.D. of Encke's Comet, &c. Mr. Maclear.
Micrometrical Measures of *Antares*. Mr. Maclear.

Occultation of *Jupiter* by the Moon. Mr. Chalmers.
Corrections to be applied to Sextant Observations. Mr. W. H. Simms.
On Finding a Meridian. Mr. Hart.
Note accompanying Drawings of *Mars*. Capt. Jacob.
Occultation of *Jupiter* by the Moon, Nov. 8, 1856. Lord Wrottesley.
Telescopic Appearance of *Saturn*. Rev. W. R. Dawes.
Lunar Occultation of *Jupiter's* Fourth Satellite. Rev. W. R. Dawes.
Occultation of *Jupiter* by the Moon, Nov. 8. Mr. De La Rue.
Observations of *Jupiter*, Oct. 1856. Mr. De La Rue.
Formulæ for the Determination of Latitude by observed Transits of Stars near Prime Vertical. Mr. W. H. Simms.
Occultation of *Jupiter*, Nov. 8. Mr. Huggins.
Observations of *Antares*. Mr. Hippisley.
On the Projection of Stars on Disk of Moon. Capt. Jacob.
On the Division of the Outward Ring of *Saturn*. Mr. Hartnup.
Results of Observations of Small Planets. Mr. Airy.
Magnitudes of Thirty-six Minor Planets. Mr. Pogson.
Occultation of *Jupiter*, Nov. 8. Mr. Goddard.
Annular Eclipse, Sept. 18, 1857, Calculated Position of Central and Limiting Line. Lieut. Tennant.
Occultation of *Jupiter*, Nov. 8. Mr. Grove.
Do. do. do. Mr. Burr.

Dec. 8. On a Mode of Constructing Tubes for Telescopes. Mr. Brodie.
Note accompanying Drawings of *Jupiter*, &c. Mr. Huggins.
Do. do. do. Mr. Barclay.
On Variable Stars. Mr. Pogson.
Results of Observations of Minor Planets. Mr. Airy.
Proposed Method of relieving Weight of an Azimuth, &c. Lieut. Tennant.

1857.

Jan. 9. On the Projection of Stars on the Moon. Mr. Hippisley.
Occultations observed at Highbury. Mr. Burr.
Occultation of *Jupiter*, Jan. 2, 1857. Mr. Burr.
Do. do. do. Mr. Huggins.
Do. do. do. Mr. Lowe.
Do. do. do. Dr. Mann.
Do. do. do. Mr. Watson.
Do. do. do. Rev. S. W. Webb.
Do. do. do. Mr. Jeans.
Do. do. do. Mr. Perigal.
Do. do. do. Rev. W. R. Dawes.
Do. do. do. Mr. Brodie.

Occultation of *Jupiter*.	Jan. 2,	1857.	Dr. Lee.
Do.	do.	do.	Rev. C. Lowndes.
Do.	do.	do.	Dr. Brereton.
Do.	do.	do.	Dr. Turnbull.
Do.	do.	do.	Mr. Dell.
Do.	do.	do.	Lord Wrottesley.
Do.	do.	do.	Mr. Peto.

Various Observations. Mr. Lassell.
Notice of Solar Observations. Mr. Carrington.
On the Horary Variation of Meteors. Mr. Bompas.

Occultation of *Jupiter*,	Jan. 2.	Mr. Airy.
Do.	do.	Mr. Hodgson.

Projection of *Jupiter's* Satellite on the Disk of the Planet. Mr. Hodgson.

Occultation of *Jupiter*,	Jan. 2.	Dr. Robinson.
Do.	do.	Mr. Worthington.
Do.	do.	Mr. Pogson.
Do.	do.	Mr. Hartnup.
Do.	do.	Mr. Jee.
Do.	do.	Rev. J. Slatter.

List of Public Institutions and of Persons who have contributed to the Society's Library, &c. since the last Anniversary.

Her Majesty's Government.
Royal Society of London.
Royal Society of Edinburgh.
Royal Geographical Society.
Royal Asiatic Society.
Royal Institution.
Royal Irish Academy.
Royal Dublin Society.
Geological Society.
Linnean Society.
Photographic Society.
Zoological Society.
Society of Arts.
Philosophical Society, Liverpool.
Philosophical Society, Manchester.
Historic Society of Lancashire.
British Association.
Institute of Actuaries.
Hon. East India Company.
The Lords Commissioners of the Admiralty.
The Commissioners of the Exhibition of 1851.
The Registrar-General.
The Superintendent of the Nautical Almanac.
The Radcliffe Trustees.
University College, London.

Royal Observatory, Edinburgh.
L'Académie Impériale des Sciences de l'Institut de France.
L'Observatoire Impérial de Paris.
Le Bureau des Longitudes.
Le Dépôt Général de la Marine.
L'Académie des Sciences de Dijon.
The Society at Cherbourg.
Imperial Academy of Vienna.
Imperial Observatory of Vienna.
Royal Academy of Munich.
Royal Observatory of Munich.
Royal Academy of Berlin.
Royal Academy of Brussels.
Royal Society of Göttingen.
The Society of Wurzburg.
The Society of Danzig.
The Society of Geneva.
The Society of Naples.
Royal Academy of Sciences, Madrid.
Royal Observatory, Königsburg.
Royal Observatory, Palermo.
American Government.
American Academy of Sciences.
American Philosophical Society.
Franklin Institute.
Smithsonian Institution.
Observatory at Harvard College.
Observatory at George Town College.
Observatory at San Fernando.
Philosophical Society of Victoria.
The Editor of the Athenæum Journal.
The Editor of the Literary Gazette.
The Editor of the Critic.
The Editor of the Civil Engineers and Architect's Journal.

G. B. Airy, Esq.
C. Babbage, Esq.
Prof. A. D. Bache.
M. Biot.
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M. F. Winnecke.
W. S. B. Woolhouse, Esq.
Dr. R. Wolf.

Address delivered by the President, M. J. Johnson, Esq., on presenting the Medal of the Society to M. Schwabe:—

Gentlemen,—The order of our proceedings has now brought us to the presentation of the medal which, as you have heard, the Council has awarded to M. Schwabe, for his discovery of the periodicity of the solar spots.

M. Heinrich Schwabe is a gentleman resident in, and I believe a native of, Dessau, the capital of the Duchy of Anhalt Dessau, who, having no professional duties, has devoted much time and attention to scientific studies, and has attained considerable reputation in other departments of knowledge than that in which he is known to this Society. Among other accomplishments, I am informed that M. Schwabe is an excellent botanist, and has composed, though, I believe, not published, a flora of the neighbourhood of Dessau.

It was in 1826 that he entered upon those researches which are now to engage our attention. I am not aware of the motive that induced him—whether any particular views had suggested themselves to his own mind—or whether it was a general desire of investigating, more thoroughly than his predecessors had done, the laws of a remarkable phenomenon, which it had long been the fashion to neglect. He could hardly have anticipated the kind of result at which he has arrived; at the same time we cannot imagine a course of proceeding better calculated for its detection, even if his mind had been prepared for it, than that which he has pursued from the very commencement of his career. Assuredly if he entertained such an idea, it was not borrowed from the

authorities of the last century, to whom the solar spots were objects of more attention than they have been of late years.

"Nulla constanti temporum lege apparent aut evanescunt," says Keill in 1739.—*Introduct. ad Physic. Astronom.* p. 253.

"Il est manifest par ce que nous venons de rapporter qu'il n'y a point de règle certaine de leur formation, ni de leur nombre et de leur figure," says Cassini II. in 1740.—*Elém. d'Astron.* vol. i. p. 82.

"Il semble qu'elles ne suivent aucune loi dans leur apparitions," says Le Monnier in 1746.—*Instit. Astron.* p. 83.

"Solar spots observe no regularity in their shape, magnitude, number, or in the time of their appearance or continuance," says Long in 1764.—*Astron.* vol. ii. p. 472.

"Les apparitions des tâches du soleil n'ont rien de regulier," says Lalande in 1771.—*Astron.* vol. iii. § 3131, 2d edit.

And Delambre's opinion may be inferred from a well-known passage in the third volume of his *Astronomy* (p. 20), published in 1814, where treating of the solar spots he says, "Il est vrai qu'elles sont plus curieuses que vraiment utiles."

I cite these passages to show, whatever might have been Schwabe's own view of the matter, that a periodicity of the spots was not a current idea at the time he entered upon the subject, and therefore that he has not merely developed a law for which men's minds were prepared, but that he has been, to all intents and purposes, the discoverer of it. The first suggestion I have met with (and that a very vague one) of anything of the kind occurs in the article "Sonnenflecken," in Gehler's *Physicalisches Wörterbuch*, written by the elder Littrow, and published in 1836, long after Schwabe had been at work.

It was in 1826, as I have said, that Schwabe began his observations, but I am not aware of any published results before those in No. 350 of the *Astronomische Nachrichten*, which appeared in April 1838. Here he gives a summary of twelve years' labour, and though at this time he must have begun to foresee the issue, for the indications of periodicity are plain, he makes no remark, nor does the memoir appear to have attracted the attention of astronomers.

From this time commence his annual contributions to the *Astronomische Nachrichten;* but it was not till the end of 1843, when he had passed through two periods of maximum and minimum, that he very modestly remarks that his observations heretofore had given indications of periodicity which that year's result tended to confirm. Still the subject attracted little attention. As far as I can discover, the only person who had taken it up was Julius Schmidt, the present indefatigable Director of the Observatory at Olmütz, then residing near Hamburg. But the philosopher of Dessau was not disconcerted; he went on accumulating fresh proofs of his great discovery, which, when announced in 1851, by Alexander Von Humboldt in the third volume of his immortal *Cosmos*, came upon the world with all the freshness of

novelty, though in reality the secret had been revealed eight years before.

Now, gentlemen, what were the means and processes by which Schwabe arrived at his results? These he tells us in No. 350 of the *Astronomische Nachrichten*, to which I have already referred.

His instruments are two telescopes, by Frauenhofer, one a $3\frac{1}{2}$, the other a 6-foot, with powers of 45, 64, and 96, the last only used in extreme cases. The apertures of his object-glasses were generally reduced to $1\frac{3}{4}$-inch and $2\frac{1}{2}$-inches, an arrangement by means of which he obtained the double advantage of being able to protect his coloured glasses, and to use lighter tints than would have been otherwise practicable. He particularly recommends glasses of a certain blue tint which he obtained from Munich.

His observatory, I am informed by Mr. Carrington, is a small apartment on the top of his dwelling-house.

His method of observation is as simple as his apparatus, and he has felt throughout his inquiries the force of the precept, as necessary in cases of this kind as in that which the poet had especially in view,—

> "Servetur ad imum,
> Qualis ab incepto processerit, et sibi constet;"

from first to last he has never altered his system of classification and registration.

His plan is to note by a number each spot in the order of its appearance, carrying on his notation from the first to the last spot in each year. He reckons an isolated spot, or a cluster of spots where there is no visible separation between their penumbræ, as one group. "Hence," he observes, "the number of *spots* will depend in a great measure on the excellence of the telescope; and it often happens that clusters of many hundred, nay of many thousand spots, will be designated by one number only, just as a single isolated spot will be. So great, however, is the sun's tendency to present his spots in the form of clusters, that other observers will, in the course of a year, assuredly not find any great difference between their numbers and mine." But he particularly impresses on his readers that he attaches importance not so much on the absolute number of the groups, as on the ratio which obtains between them in different years.

The result of his investigations, as you are aware, has been to establish with a degree of probability almost amounting to certainty, that the solar spots pass through the phases of maximum and minimum frequency, and *vice versâ*, in a period not very different from ten years.

The exact period Schwabe does not pretend to have determined. That it is liable to perturbation is evident. During twenty-seven years of the series the results were extremely regular; during the last three years they have shown symptoms of disturbance. The epoch of minimum, which, consistently with earlier indications, should have happened in 1853, did not occur until 1856.

Such is the brief history of thirty years' labour, which, had I wished, I could hardly have prolonged: in fact, descriptively, there is little more to say about it.

You will have observed that the instruments were of the simplest kind. And though the arrangements in the first instance, as must be the case in all physical researches, called for the exercise of thought and intelligence—qualities the possession of which, in a very high degree, no one who reads M. Schwabe's papers in the *Astronomische Nachrichten* will deny him—these arrangements once made, the observations were of a description requiring for their prosecution more experience than skill.

It was not then for them, or for any special difficulty attending the research, that your Council has thought fit to confer on M. Schwabe this highest tribute of the Society's applause. What they wish most emphatically to express is their admiration of the indomitable zeal and untiring energy which he has displayed in bringing that research to a successful issue.

Twelve years, as I have said, he spent to satisfy himself—six more years to satisfy, and still thirteen more to convince, mankind. For thirty years never has the sun exhibited his disk above the horizon of Dessau without being confronted by Schwabe's imperturbable telescope, and that appears to have happened on an average about 300 days a-year. So, supposing that he observed but once a-day, he has made 9000 observations, in the course of which he discovered about 4700 groups. This is, I believe, an instance of devoted persistence (if the word were not equivocal, I should say, pertinacity) unsurpassed in the annals of astronomy. The energy of one man has revealed a phenomenon that had eluded even the suspicion of astronomers for 200 years!

Let us hope that the example will not be lost. Men are apt to speak of astronomy as an exhausted science, meaning that all that can be known is known. No doubt being the most perfect, it is in one sense the most exhausted science. But the astronomer of Dessau has taught us that there are still mines rich in ore, though they lie deep buried, and must be worked with more assiduity and with more care. I can conceive few more unpromising subjects, from which to extract a definite result, than were the solar spots when Schwabe first attacked them.

The only recent instance of perseverance, I can call to mind, comparable with the one before us, is that of Hencke, of Driessen, who is said to have spent the leisure of fifteen years in search of another planet; and at last, by the discovery of *Astræa*, gave the impulse which, responded to by Mr. Hind, De Gasparis, and others, has numerically increased more than four-fold the known members of the solar system. The achievement in either case may not fall within the category of works of genius—but both resulted from qualities of mind scarcely less rare than genius, and are precisely of a kind that genius alone never could accomplish.

The observations of Julius Schmidt, and Professor Wolf, lately

of Berne, now, I believe, of Zurich, who has regularly observed the spots since 1849, fully confirm the general accuracy of Schwabe's results. But we are naturally led to inquire whether we can connect them with the statements of former observers. Professor Wolf, who has entered deeply into the general question, published a few years ago, in the *Memoirs of the Philosophical Society of Berne*, all the notices he was able to find, scattered in books and memoirs, from the time of the discovery of the spots in 1611; and from a comparison of them with more modern determinations he deduced a period 11·1 years. Without depreciating the industry and ingenuity displayed in that paper, I confess I am not disposed to place much reliance on the result, owing to the insufficient data on which it appears to me to be founded. The inquiry is rendered very difficult, because the old observers attended much more to the physical characteristics of the spots, and to their time of rotation, than to their number. Moreover, I know only of Scheiner and Derham who observed them continuously for any length of time—that is to say, for more than two or three years. Scheiner's attention was almost exclusively directed to physical peculiarities; and Derham's investigations (*Phil. Trans.* 1711) were obviously very desultory.

Schwabe has not entered into speculations relative to the nature and origin of the spots, though he has been careful to note all remarkable appearances as they occurred; and of these he has given an admirable summary in the *Astronomische Nachrichten*, No. 473. There he calls attention to an appearance which, he says, is not uncommon, but which he cannot explain on the generally received theory, that the spots are portions of the surface of a solid body, seen through openings in a luminous atmosphere that surrounds it at a distance, and another intervening atmosphere. This theory of Sir W. Herschel, as you are aware, has been found adequate to explain most of the phenomena of the spots. But the case to which Schwabe alludes is this. On the above hypothesis a spot surrounded by a penumbra, will, by the effect of perspective, when it first makes its appearance on the disk, seem to be excentrically situated on the penumbra, the border of the penumbra towards the sun's centre appearing less broad than the other border. All this is intelligible,—but why is not the penumbra equally illuminated all round? For it frequently happens that the border turned towards the sun's centre is dark grey, while that towards the sun's limb is bright grey, and between the latter and the nucleus there is a string of light almost as bright as the sun's disk.

He also mentions having seen, though rarely, the phenomenon which, I find in Arago's notice of the life and works of Sir William Herschel, furnished Francis Wollaston, and Lalande, with an argument against Alexander Wilson, who was the first to advance the theory of the spots being cavities. The phenomenon is this:—Sometimes a spot surrounded by a penumbra passes over

the sun's disk without the former undergoing any change of relative position, from the beginning to the end of its course. This apparently militates against the cavity theory. Arago says the objection is not insurmountable. "Suppose," says he, "in such cases, that the sides of the openings in the photosphere, through which the spot appears, are not sloping." But according to Wilson's theory the penumbra is *formed* by the sloping sides of the photosphere—and there *is* the penumbra. Therefore it appears to me that this explanation does not hold good on Wilson's view. According to Sir W. Herschel another stratum is interposed between the solid body of the sun and the photosphere. On this hypothesis, it is the part we see of the secondary stratum which constitutes the penumbra; if therefore it be sensibly depressed below the surface of the photosphere a change of relative position must ensue. Schwabe's explanation is, that when the phenomena in question occur the secondary stratum has risen to an unusual height, and is *not* sensibly depressed below the photosphere.

There is another appearance, on which he lays much stress, "Lichtflocken," (light flakes,) which he conceives to be particles of matter, floating on the verge of our atmosphere. But I must not exhaust your patience by entering into details, and refer those who are interested in the subject to Schwabe's own excellent description in No. 350 of the *Astronomische Nachrichten*.

There is, however, one more topic too closely connected with our subject, and too remarkable to pass unnoticed.

You are aware, gentlemen, it has been long known that the intensity of magnetic declination is subject to a daily variation; and this variation was also known to be in some way connected with the sun, attaining its maximum western limit when that body is at its upper and lower culmination, and its maximum eastern limit about 6 o'clock in the morning and evening. These are not the exact times, but they are sufficiently near for our purpose. About the year 1850, Professor Lamont announced that this variation was again liable to another variation, which observed a period, from maximum to minimum, and from minimum to maximum, of about 10 years. He was led to this result by a discussion of his own observations at Munich. It was shortly after fully confirmed by our colleague, General Sabine, by the observations made at the Magnetic Observatories of Toronto and Hobarton. But in the course of the latter discussions General Sabine detected another important circumstance which had escaped Lamont, viz., that the periods of maximum variation of the declination-needle corresponded exactly with those of the maximum frequency of the solar spots, and *vice versâ*, the minimum of the one with the minimum of the other. Hardly had General Sabine's paper been read before the Royal Society on March 18, 1852, when intelligence was received that two Swiss physicists, Professor Gautier of Geneva, and Professor Wolf of Berne, had arrived at the same conclusion, independently of each other, from a perusal of Lamont's results.

All the observations I have mentioned, were made during nearly the same time—between the years 1840 and 1851—comprehending only a single period of change. Obviously, therefore, in this state of the inquiry it was of the highest importance to obtain a trustworthy series made at another time and under different circumstances. Though hardly to be expected, it happened, most fortunately, that such a series was at hand.

The diurnal variation was one of those subjects which, many years ago, had particularly interested the vigorous mind of the lamented Arago; and among his papers were found the records of a most laborious course of experiments, conducted with all the care which no one knew better than he how to bestow on a delicate investigation. These experiments, extending from 1820 to 1831, have been rigorously discussed by M. Thoman, and exhibit the prevalence of the same law that obtains in the later series.

Nor does the evidence of connexion rest here. In a recent paper sent to the Royal Society, General Sabine has shown that at Toronto (the only series hitherto fully discussed) all the magnetic elements subjected to observation undergo similar variations. In the face of these coincidences, to doubt the relationship between the two phenomena seems to me to be almost as unreasonable as to doubt the influence of the moon on the tides of the ocean.

M. Schwabe's service has been the discovery of an important astronomical fact, falling strictly within the cognisance of this Society. His merits are in no way affected, though, no doubt, the value of his discovery is enhanced, by this remarkable episode. No longer is its scope confined to the disclosure of a physical peculiarity in the constitution of the sun. It promises to be the means of revealing the prevalence of a principle, throughout the solar system, co-extensive with gravitation, and of establishing another link in the chain of analogies binding Earth with other worlds, the ultimate effect of which on the progress of physical research no one can foresee.

The President, then delivering the Medal to Mr. Carrington, addressed him in the following terms:—

I request you will transmit this medal to Mr. Schwabe with the expression of our highest admiration of the ability and zeal with which he has conducted his laborious series of observations on the solar spots—with our hearty congratulations on the results which he has already obtained, and on the bright prospect now opening of their augmented importance. Add, also, our best wishes that his life may be long spared to continue, and to see continued, the course of observations which he has so gloriously commenced.

The Meeting then proceeded to the election of the Officers and Council for the ensuing year, when the following Fellows were elected:—

President:

George Bishop, Esq. F.R.S.

Vice-Presidents:

Rev. George Fisher, M.A. F.R.S.
Manuel J. Johnson, Esq., M.A. F.R.S. Radcliffe Observer
Rev. Robert Main, M.A.
Rev. Baden Powell, M.A. F.R.S.

Treasurer:

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Warren De La Rue, Esq. F.R.S.

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John Russell Hind, Esq. Superintendent of the Nautical Almanac.

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Rev. C. Pritchard, F.R.S.
William Simms, Esq. F.R.S.
Admiral W. H. Smyth, K.S.F. D.C.L. F.R.S.

The Astronomer Royal has kindly announced that he is prepared to give an oral lecture at the Meeting of the Society, on the 8th of April next, on "The Means that will be available for Correcting the Measure of the Sun's Distance for several years to come," including, with other things, the Transits of *Venus* of 1874 and 1882.

ERRATA.

Vol. XVII., page 5, line 13, *for* of the bright edge, *read* at the bright edge.

— — — 10, — 10, *for* 27°, *read* 270.

— — — 23, — 12, *for* observation, *read* obscuration.

— — — 29, in Mr. Tennant's paper, throughout, *for* frustrum, *read* frustum.

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